between: a retracted state (shown in FIG. **4**), wherein the deformable regions **126** are substantially flush with the undeformable region **128**; and an expanded state (shown in FIG. **5**), wherein the deformable regions **126** are substantially proud of the undeformable region **128**. The substrate **130** is joined to the back surface **124** of the undeformable region **128** and defines at least one fluid port **134** per deformable region **126**, and a fluid channel **132**, wherein the fluid ports **134** communicate the fluid **110** between the fluid channel **132** and the back surfaces **124** of the deformable regions **126**. The displacement device **140** displaces a portion of the fluid **110** through the fluid channel **132** and the fluid ports **134** to transition the deformable regions **126** from the retracted state to the expanded state. The first and second pressure sensors **150**, **160** detect changes in fluid pressure within a portion of the fluid **110** due to an input force applied to the tactile surface **122** at a particular deformable region **126** (such as in a user input state shown in FIG. **6**). The processor **170** determines the particular deformable region **126** to be an input location based upon a comparison of the changes in fluid pressure detected by the first and second pressure sensors **150**, **160**. The processor **170** may further characterize input forces received at the tactile surface **122** as various input types based upon fluid pressure change rates, fluid pressure magnitude, or time-dependent changes in the fluid pressure. The substrate **130** may further define a support surface **138** that provides a hard stop for the deformable regions **126** of the tactile layer **120** such that a user may not inwardly deform a deformable region **126** past a certain depth, such as flush with the undeformable region **128**, as shown in FIG. **6**. Furthermore, an attachment point **136** may join the tactile layer **120** to the substrate **130** and define a border between a deformable region **126** and an undeformable region **128**.

[0022] The user interface system **100** may further include one or more of the following: a valve **180**; a touch sensor **190**; and a display **200**. The valve **180** may isolate fluid within a single fluid port and deformable region pair, within a plurality of fluid ports and deformable region pairs, or within a portion of the fluid channel **132**. The valve **180** preferably retains a portion of the fluid no at the back surface **124** of at least one deformable region **126** to maintain the deformable region **126** in either the expanded state or retracted state. The touch sensor **190** preferably detects a user touch **129** on the tactile surface **122**, such as at the undeformable region **128**. The display **200** preferably outputs an image that is transmitted, through the substrate **130** and the tactile layer **120**, to a user.

[0023] The user interface system **100** functions to provide tactile guidance to a user by expanding and retracting the deformable regions **126** to form distinguishable input regions on the tactile surface **122** of the tactile layer **120**, as described in U.S. patent application Ser. No. 12/497,622 titled "User Interface system," which is incorporated in its entirety by reference. The processor **170** and the first and second pressure sensors **150**, **160** cooperate to determine the location of an input force **129** applied to the tactile surface **122**. Specifically, the pressure sensors and processor **170** cooperate to select, from the plurality of deformable regions **126**, the particular deformable region **126** to which the input force **129** was applied. The user interface system **100** is preferably incorporated into an electronic device **210** that includes a digital display, such as the display of an automotive console, a desktop computer, a laptop computer, a tablet computer, a television, a radio, a desk phone, a mobile phone, a PDA, a personal navigation device, a personal media player, a camera, a gaming console or controller, a remote control, or a watch. Such electronic devices often incorporate touch sensors and/or touch displays incorporating capacitive, optical, or resistive touch-sensing technology, or possibly other touch-sensing methods. However, drawbacks may exist in relying on such technology to detect user inputs on deformable tactile surfaces of such electronic devices. Therefore, detecting user inputs at the deformable regions **126** by sensing pressure changes within the fluid **110** used to deform the deformable regions **126** may be more reliable and/or effective than current touch sensor technology. By coupling each fluid port **134** and associated deformable region **126** to a central fluid channel **132**, the number of pressure sensors necessary to isolate the input force location may be substantially reduced. In an example of the user interface device arranged on a display **200** of an electronic device **210**, wherein a keypad including twenty-six letters is rendered on the display **200**, the tactile layer **120** includes an array of twenty-six deformable regions **126**, each a separate input region aligned with an image of different letter; the deformable regions **126** are coupled to the single fluid channel **132** via fluid ports **134**, and the displacement device **140** expands all of the deformable regions **126** simultaneously such that the user may tactilely distinguish between any two input regions (deformable regions **126**). Rather than implement twenty-six individual pressure sensors (i.e. one sensor per input region), substantially fewer (e.g., two) pressure sensors detect fluid pressure changes within the fluid channel **132** and the processor **170** interprets the signals from the pressure sensors to isolate (i.e. determine) a particular deformable region **126** to which the input force **129** is applied by a user. The tactile layer **120** and substrate **130** are preferably substantially transparent such that images on the display **200** may be viewed by the user. However, the user interface system **100** may be incorporated into any device in any way to reduce the number of sensors and/or sensor complexity required to capture a user input on a deformable tactile surface **122**.

2. The Volume of Fluid

[0024] The volume of fluid **110** of the preferred embodiment functions as the medium by which pressure is conveyed to the deformable regions **126** to expand or retract the deformable regions **126** and by which forces applied to the tactile surface **122** are conveyed to the pressure sensors **150**, **160**. The fluid no is preferably a substantially incompressible fluid, but may alternatively be a compressible fluid or any other suitable fluid sustaining a pressure change during operation of the user interface system **100**. The fluid **110** is preferably a liquid (such as water, glycerin, or ethylene glycol), but may alternatively be a gas (such as air, nitrogen, or argon) or any other substance (such as a gel or aerogel) that expands the deformable region **126** and deforms the tactile surface **122**. The fluid **110** preferably substantially fills the fluid ports **134** and the fluid channel **132** and is substantially isolated from other fluids that may be external to the user interface system **100** (or the electronic device **210** to which the user interface system **100** is attached), which may reduce the likelihood of air other potential contaminants entering and/or creating bubbles within the fluid **110** that may disrupt the transmission of an image through the user interface system **100**. However, any other suitable type of the fluid **110** may be used.

[0025] The volume of fluid is preferably substantially transparent such that an image generated by the display **200** may be transmitted through the fluid **110**. The volume of fluid